

Claims

- [c1] 1. An LED device, comprising:
a substrate;
a first doped layer of a first conductivity type on the substrate;
a light emitting layer on a portion of the first doped layer;
a second doped layer of a second conductivity type on the light emitting layer, wherein the second doped layer, the light emitting layer, and the first doped layer together constitute an active layer, and the active layer has a rough sidewall capable of preventing total reflection of a light incident to the sidewall; and
two electrodes on the first doped layer and the second doped layer, respectively.
- [c2] 2. The LED device of claim 1, wherein the sidewall of the active layer has a plurality of pillar-shaped bumps thereon resulting in the roughness thereof.
- [c3] 3. The LED device of claim 2, wherein the pillar-shaped bumps comprise a plurality of semicircular pillar-shaped bumps.

- [c4] 4. The LED device of claim 1, wherein the second doped layer comprises a rough top surface.
- [c5] 5. The LED device of claim 1, wherein the substrate comprises a sapphire substrate.
- [c6] 6. The LED device of claim 1, wherein the first doped layer, the light emitting layer and the second doped layer are constituted of a semiconductor material of a III-V group compound.
- [c7] 7. The LED device of claim 6, wherein the III-V group compound is selected from the group consisting of GaN, GaP, and GaAsP.
- [c8] 8. The LED device of claim 1, wherein the light emitting layer comprises a quantum well-type light emitting layer.
- [c9] 9. The LED device of claim 1, wherein the first doped layer is an N-doped layer, and the second doped layer is a P-doped layer.
- [c10] 10. The LED device of claim 1, wherein the first doped layer is a P-doped layer, and the second doped layer is an N-doped layer.
- [c11] 11. An LED device, comprising:
a substrate;
an active layer on the substrate, wherein the active layer

comprises an N-doped layer, a P-doped layer and a light emitting layer disposed in between, and the active layer has a rough sidewall capable of preventing total reflection of a light incident to the sidewall; and two electrodes on the first doped layer and the second doped layer, respectively.

[c12] 12. The LED device of claim 11, wherein the sidewall of the active layer has a plurality of pillar-shaped bumps thereon resulting in the roughness thereof.

[c13] 13. The LED device of claim 12, wherein the pillar-shaped bumps comprise a plurality of semicircular pillar-shaped bumps.

[c14] 14. The LED device of claim 11, wherein the active layer comprises a rough top surface.

[c15] 15. The LED device of claim 11, wherein the substrate comprises a sapphire substrate.

[c16] 16. The LED device of claim 11, wherein the N-doped layer, the light emitting layer, and the P-doped layer are constituted of a semiconductor material of a III-V group compound.

[c17] 17. The LED device of claim 16, wherein the III-V group compound is selected from the group consisting of GaN,

GaP, and GaAsP.

- [c18] 18. The LED device of claim 11, wherein the light emitting layer comprises a quantum well-type light emitting layer.